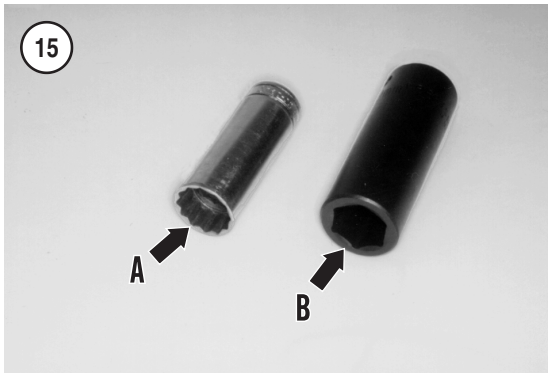
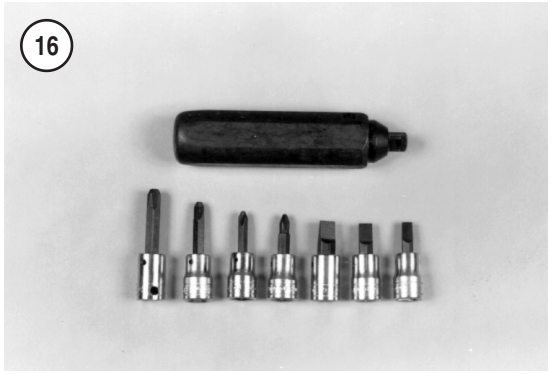




drive size indicates the size of the square hole that accepts the ratchet handle. The number stamped on the socket is the size of the work area and must match the fastener head.

As with wrenches, a 6-point socket provides superior holding ability, while a 12-point socket needs to be moved only half as far to reposition it on the fastener.

Sockets are designated for either hand or impact use. Impact sockets are made of thicker material for more durability. Compare the size and wall thickness of a 19-mm hand socket (A, **Figure 15**) and the 19-mm impact socket (B). Use impact sockets when using an impact driver or air tools. Use hand sockets with hand-driven attachments.

WARNING

Do not use hand sockets with air or impact tools. They may shatter and cause injury. Always wear eye protection when using any type of impact or air tool.

Various handles are available for sockets. The speed handle is used for fast operation. Flexible ratchet heads in varying lengths allow the socket to be turned with varying force and at odd angles. Extension bars allow the socket setup to reach difficult areas. The ratchet is the most versatile wrench. It allows the user to install or remove the nut without removing the socket.

Sockets combined with any number of drivers make them undoubtedly the fastest, safest and most convenient tool for fastener removal and installation.

Impact Driver

An impact driver provides extra force for removing fasteners by converting the impact of a hammer into a turning motion. This makes it possible to remove stubborn fasteners without damaging them. Impact drivers and interchangeable bits (**Figure 16**) are available from most tool suppliers. When using a socket with an impact driver, make sure the socket is designed for impact use. Refer to *Socket Wrenches, Ratchets and Handles* in this section.

WARNING

Do not use hand sockets with air tools or impact drivers, as they may shatter the socket and cause personal injury. Always wear eye protection when using any type of impact or air tool.

Allen Wrenches

Allen or setscrew wrenches (**Figure 17**) are used on fasteners with hexagonal recesses in the fastener head. These wrenches are available in L-shaped bars, sockets and T-handles. A metric set is required when working on most motorcycles made by Japa-

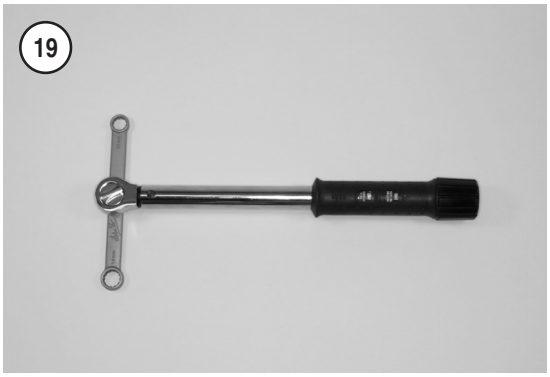
nese and European manufacturers. Allen head bolts are sometimes called socket bolts.

Torque Wrenches

A torque wrench is used with a socket, torque adapter or similar extension to tighten a fastener to a measured torque. Torque wrenches come in several drive sizes (1/4, 3/8, 1/2 and 3/4) and have various methods of reading the torque value. The drive size indicates the size of the square drive that accepts the socket, adapter or extension. Common methods of reading the torque value are the deflecting beam (A, **Figure 18**), the dial indicator (B) and the audible click (C).

When choosing a torque wrench, consider the torque range, drive size and accuracy. The torque specifications in this manual provide an indication of the range required.

A torque wrench is a precision tool that must be properly cared for to remain accurate. Store torque wrenches in cases or separate padded drawers within a toolbox. Follow the manufacturer's instructions for their care and calibration.



Torque Adapters

Torque adapters extend or reduce the reach of a torque wrench. The torque adapter shown in **Figure 19** is used to tighten a fastener that cannot be reached due to the size of the torque wrench head, drive, and socket. Since a torque adapter changes the effective lever length (**Figure 20**) of a torque wrench, the torque reading on the wrench does not equal the actual torque applied to the fastener. It is necessary to recalibrate the torque setting on the wrench to compensate for the change of lever length. When a torque adapter is used at a right angle to the drive head (**Figure 19**), calibration is not required, since the effective length has not changed.

To calculate the adjusted torque reading when using a torque adapter, use the following formula and refer to **Figure 20**. The formula can be expressed as:

$$TW = \frac{TA \times L}{L + A}$$

TW is the torque setting or dial reading on the wrench. *TA* is the torque specification and the actual amount of torque that will be applied to the fastener. *A* is the amount that the adapter increases (or in some cases reduces) the effective lever length as measured along the centerline of the torque wrench from the center of the drive to the center of the adapter box end (**Figure 20**). *L* is the lever length of the wrench as measured from the center of the drive to the center of the grip. The effective length of the torque wrench is the sum of *L* and *A*.

For example, to apply 20 ft.-lb. to a fastener, using an adapter as shown in the top example in **Figure 20**:

TA = 20 ft.-lb.

A = 3 in.

L = 14 in.

$$TW = \frac{20 \times 14}{14 + 3} = \frac{280}{17} = 16.5 \text{ ft. lb.}$$

In this example, a click-type torque wrench would be set to the recalculated torque value (TW = 16.5 ft.-lb.). When using a dial or beam-type torque wrench, tighten the fastener until the pointer aligns with 16.5 ft.-lb. In either case, although the torque wrench reads 16.5 ft.-lb., the actual torque is 20 ft.-lb.